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PATENT APPLICATION

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(HDP#6215-000130/US)

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Nicos A. VEKIARIDES

Confirmation No.: 4607

Application No.: 09/664,499

Examiner: Hussein El-Chanti

Filing Date: Sept. 18, 2000

Group Art Unit: 2157

Title: INTERNET PROTOCOL DATA MIRRORING

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on **May 4, 2006**.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $500.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

08/29/2006 NBERHE 00000010 082025 09664499
01 FC:1402 500.00 DA

( ) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

( )	one month	$120.00
( )	two months	$450.00
( )	three months	$1020.00
( )	four months	$1590.00

( ) The extension fee has already been filled in this application.

(X) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **08-2025** the sum of $500.00. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

( ) I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450. Date of Deposit: (HAND CARRY)

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( ) I hereby certify that this paper is being transmitted to the Patent and Trademark Office facsimile number_____ on _____

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Respectfully submitted,

Nicos A. VEKIARIDES

By

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Rev 12/04 (Aplbrief)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS:	Nicos A. VEKIARIDES	CONF:	4607
SERIAL NO.:	09/664,499	GROUP:	2157
FILED:	September 18, 2000	EXAMINER:	Hussein El-Chanti
FOR:	INTERNET PROTOCOL DATA MIRRORING		

APPELLANT'S BRIEF ON APPEAL UNDER 37 C.F.R. §41.37

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Randolph Building
401 Dulany Street
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Due: August 25, 2006

Sir:

This is an Appeal Brief in response to the Final Rejection mailed January 30, 2006, of Claims 1-24 and 26-49. A Notice of Appeal from this Final Rejection was timely filed on May 4, 2006. A Notice of Panel Decision From Pre-Appeal Brief Review was mailed on July 25, 2006. No petition for an extension of time is believed necessary. Concurrently but separately filed is a transmittal letter that includes an authorization to charge Deposit Account No. 08-2025 for the requisite governmental fee for the filing of an Appeal Brief.

08/29/2006 MBERHE 00000010 09664499
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I. REAL PARTY IN INTEREST

The real party in interest is The Hewlett-Packard Company ("HP"). A chain of title to the present application from the inventors to HPDC (a limited partnership formed by HP), and evidence thereof, is as follows.

Inventor ⇨ STORAGEAPPS, INC.

- By virtue of and as evidenced by an Assignment recorded at the United States Patent and Trademark Office ("USPTO"); see Reel No. 011138, Frame No. 0945.
- Recorded: September 18, 2000
- Nicos A. Vekiarides assigns to StorageApps, Inc.
- Nature of conveyance: assignment of assignor's interest

STORAGEAPPS, INC. ⇨ HEWLETT-PACKARD COMPANY

- By virtue of and as evidenced by an Assignment recorded at the USPTO; see Reel No. 011976, Frame No. 0470
- Recorded: September 19, 2001
- StorageApps, Inc. assigns to Hewlett-Packard Company
- Nature of conveyance: assignment of assignor's interest

STORAGEAPPS, INC. ⇨ HEWLETT-PACKARD COMPANY

- By virtue of and as evidenced by an Assignment recorded at the USPTO; see Reel No. 012777, Frame No. 0208
- Recorded: April 5, 2002
- StorageApps, Inc. merges with Hewlett-Packard Company
- Nature of conveyance: merger document

HEWLETT-PACKARD COMPANY ⇨
HEWLETT-PACKARD DEVELOPMENT COMPANY, L.P.

- By virtue of and as evidenced by an Assignment recorded at the USPTO; see Reel No. 014061, Frame No. 0492
- Recorded: September 30, 2003
- Hewlett-Packard Company. assigns to Hewlett-Packard Development Company, L.P.
- Nature of conveyance: assignment of assignor's interest

II. RELATED APPEALS AND INTERFERENCES

Appellant's legal representative and Assignee are aware of no appeals which will directly effect or be directly effected by or have any bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-24 and 26-49 stand finally rejected as stated in the outstanding Final Office Action. Of those, claims 1, 24, 32, 39, 48 and 49 are written in independent format. Previously, claim 25 was canceled. A clean copy of the appealed claims 1-24 and 26-49 is attached in the Claims Appendix.

IV. STATUS OF AMENDMENTS

A response that amended the claims was filed on November 14, 2005 and was entered on the record as evidenced by the Final Office Action being responsive to the November 14th Response (see Item No. 1 on Summary page of Final Office Action). No amendments have been filed after the November 14, 2005 Response. Accordingly, no Amendments have been filed after the May 4, 2006 Notice of Appeal.

V. SUMMARY OF CLAIMED SUBJECT MATTER

An example embodiment of the present invention will be discussed in the contexts of Figs. 1, 2B, 12A-12D, 12F & 13A-13E, and corresponds, e.g., to the method of claim 1 for mirroring data in a computer network (e.g., 100; e.g., see page 7, line 20, to page 8, line 16).

Such a method as in claim 1 comprises: establishing (e.g., block 1202 & page 25; e.g., block 1302 & page 33) at least one connection between a local storage server (e.g., 106; e.g., see page 8, lines 17-26) and a mirror storage server (e.g., 108; e.g., see page 8, lines 26-29); receiving (e.g., block 1204 & page 25; e.g., block 1306 & page 33) a primary storage request from a network host at the local storage server; sending (e.g., block 1206 & page 25; e.g., block 1308 & page 33) a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request; processing (e.g., block 1208 & page 26; e.g., block 1312 & page 34) the mirror storage request at the mirror storage server; sending (e.g., block 1210 & page 26; e.g., block 1322 & page 34) a first heartbeat signal (e.g., 406 & page 19, line 8) at regular first intervals from the local storage server to the mirror storage server; sending (e.g., block 1212 & page 26; e.g., block 1324 & page 34) a second heartbeat signal (e.g., 408 & page 19, line 8) at regular second intervals from the mirror storage server to the local storage server; and monitoring (e.g., block 1214 & page 26; e.g., block 1224 & page 27; e.g., block 1238 &

page 30) reception of the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

An example embodiment of the present invention will be discussed in the contexts of Figs. 1, 2B & 13A-13E, and corresponds, e.g., to the method of claim 24 for bi-directional mirroring of data in computer networks (e.g., 100; e.g., see page 7, line 20, to page 8, line 16).

Such a method as in claim 24 comprises: establishing (e.g., block 1302 & page 33) a first connection between a local storage server (e.g., 106; e.g., see page 8, lines 17-26) and a remote storage server (e.g., 108; e.g., see page 8, lines 26-29); establishing (e.g., block 1304; e.g., see page 33) a second connection between the local storage server and the remote storage server; receiving (e.g., block 1306 & page 33) a first local storage request from a first network host at the local storage server; sending (e.g., block 1308 & page 33) a first local mirror storage request from the local storage server across the first connection, wherein the first local mirror storage request corresponds to the first received local storage request; receiving (e.g., block 1310; e.g., see page 33) the first local mirror storage request at the remote storage server; storing (e.g., block 1312; e.g., see page 34) data received in the first local mirror storage request in at least one remote storage device coupled to the remote storage server; receiving (e.g., block 1314; e.g., see page 34) a first remote storage request from a second network host at the remote storage server; sending (e.g., block 1316; e.g., see page 34) a first remote mirror storage request from the remote storage server across the second connection, wherein the first remote mirror storage request corresponds to the received first remote storage request; receiving (e.g., block 1318; e.g., see page 34) the first remote mirror storage request at the local storage server; and storing (e.g.,

block 1320; e.g., see page 34) data received in the first remote mirror storage request in at least one local storage device coupled to the local storage server; sending (e.g., block 1322; e.g., see page 34) a first heartbeat signal (e.g., 406 & page 19, line 8) from the local storage server to the mirror storage server; sending (e.g., block 1324; e.g., see page 34) a second heartbeat signal (e.g., 408 & page 19, line 8) from the remote storage server to the local storage server; and monitoring (e.g., block 1326 & page 35; block 1338 & page 36) reception of the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

An example embodiment of the present invention will be discussed in the contexts of Figs. 1, 2B, 12A-12D, 12F & 13A-13E, and corresponds, e.g., to the system of claim 32 for mirroring data in a computer network (e.g., 100; e.g., see page 7, line 20, to page 8, line 16).

Such a system as in claim 32 comprises: a local storage server (e.g., 106; e.g., see page 8, lines 17-26) that receives (e.g., block 1204 & page 25; e.g., block 1306 & page 33) a storage request and outputs a mirror storage request, wherein said local storage server outputs ((e.g., block 1210 & page 26; e.g., block 1322 & page 34) a first heartbeat signal (e.g., 406 & page 19, line 8) at regular first intervals; and a mirror storage server that receives said mirror storage request, wherein said mirror storage server processes (e.g., block 1208 & page 26; e.g., block 1312 & page 34) said mirror storage request, wherein said mirror storage server outputs a response corresponding to said mirror storage request to said local storage server, wherein said mirror storage server outputs (e.g., block 1212 & page 26; e.g., block 1324 & page 34) a second heartbeat signal (e.g., 408 & page 19, line 8) at regular second intervals and monitors (e.g., block 1338 & page 36) reception of said first heartbeat signal for interruption in the regular receipt

thereof; wherein said local storage server monitors reception of said second heartbeat signal for interruption in the regular receipt thereof.

An example embodiment of the present invention will be discussed in the contexts of Figs. 1, 2B, 12A-12D, 12F & 13A-13E, and corresponds, e.g., to the computer program product that includes a computer useable medium of claim 39, the computer program logic recorded thereon enabling at least one processor to mirror data in a computer network (e.g., 100; e.g., see page 7, line 20, to page 8, line 16).

Such computer program logic recorded on a computer program product that includes a computer useable medium as in claim 39 comprises: means for enabling the processor to establish (e.g., block 1202 & page 25; e.g., block 1302 & page 33) at least one connection between a local storage server (e.g., 106; e.g., see page 8, lines 17-26) and a mirror storage server (e.g., 108; e.g., see page 8, lines 26-29); means for enabling the processor to receive a primary storage request (e.g., block 1204 & page 25; e.g., block 1306 & page 33) from a network host at the local storage server; means for enabling the processor to send (e.g., block 1206 & page 25; e.g., block 1308 & page 33) a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request; means for enabling the processor to send (e.g., block 1210 & page 26; e.g., block 1322 & page 34) a first heartbeat signal (e.g., 406 & page 19, line 8) at regular first intervals from the local storage server to the mirror storage server; and means for enabling the processor to send (e.g., block 1212 & page 26; e.g., block 1324 & page 34) a second heartbeat signal (e.g., 408 & page 19, line 8) at regular second

intervals from the mirror storage server to the local storage server; and means for monitoring (e.g., block 1214 & page 26; e.g., block 1224 & page 27; e.g., block 1238 & page 30; e.g., block 1326 & page 35; block 1338 & page 36) reception of at least one the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

An example embodiment of the present invention will be discussed in the contexts of Figs. 1, 2B, 12A-12D, 12F & 13A-13E, and corresponds, e.g., to the method of claim 48 for mirroring data in a computer network (e.g., 100; e.g., see page 7, line 20, to page 8, line 16).

Such a method as in claim 48 comprises: establishing (e.g., block 1202 & page 25; e.g., block 1302 & page 33) at least one connection between a local storage server (e.g., 106; e.g., see page 8, lines 17-26) and a mirror storage server (e.g., 108; e.g., see page 8, lines 26-29); receiving (e.g., block 1204 & page 25; e.g., block 1306 & page 33) a primary storage request from a network host at the local storage server; sending (e.g., block 1206 & page 25; e.g., block 1308 & page 33) a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request; processing (e.g., block 1208 & page 26; e.g., block 1312 & page 34) the mirror storage request at the mirror storage server; sending (e.g., block 1210 & page 26; e.g., block 1322 & page 34) a first heartbeat signal (e.g., 406 & page 19, line 8) at regular first intervals from the local storage server to the mirror storage server; sending (e.g., block 1212 & page 26; e.g., block 1324 & page 34) a second heartbeat signal (e.g., 408 & page 19, line 8), independent (e.g., see page 19, lines 9-11; e.g., see page 22, lines 11-17) of the first heartbeat signal, at regular second intervals from the mirror storage server to the local storage

server; and monitoring (e.g., block 1214 & page 26; e.g., block 1224 & page 27; e.g., block 1238 & page 30; e.g., block 1326 & page 35; block 1338 & page 36) reception of at least one the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

An example embodiment of the present invention will be discussed in the contexts of Figs. 1, 2B, 12A-12D, 12F & 13A-13E, and corresponds, e.g., to the method of claim 49 for mirroring data in a computer network (e.g., 100; e.g., see page 7, line 20, to page 8, line 16).

Such a method as in claim 49 comprises: establishing (e.g., block 1202 & page 25; e.g., block 1302 & page 33) at least one connection between a local storage server (e.g., 106; e.g., see page 8, lines 17-26) and a mirror storage server (e.g., 108; e.g., see page 8, lines 26-29); receiving (e.g., block 1204 & page 25; e.g., block 1306 & page 33) a primary storage request from a network host at the local storage server; sending (e.g., block 1206 & page 25; e.g., block 1308 & page 33) a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request; processing (e.g., block 1208 & page 26; e.g., block 1312 & page 34) the mirror storage request at the mirror storage server; sending (e.g., block 1210 & page 26; e.g., block 1322 & page 34) a first heartbeat signal (e.g., 406 & page 19, line 8) using a connectionless protocol (e.g., page 19, lines 6-14) at regular first intervals from the local storage server to the mirror storage server; sending (e.g., block 1212 & page 26; e.g., block 1324 & page 34) a second heartbeat signal (e.g., 408 & page 19, line 8) using a connectionless protocol (e.g., page 19, lines 6-14) at regular second intervals from the mirror storage server to the local storage

server; and monitoring (e.g., block 1214 & page 26; e.g., block 1224 & page 27; e.g., block 1238 & page 30; e.g., block 1326 & page 35; block 1338 & page 36) reception of at least one the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Appellant requests the Board to review on this appeal the following: (1) the rejection of claims 1-21, 24, 26-43 and 48-49 under 35 §102(b) as anticipated by U.S. Patent No. 5,574,863 to Nelson et al. ("the '863 patent"); (2) the rejection of claim 22 under 35 U.S.C. §103(a) as unpatentable over the '863 patent taken alone; and (3) the rejection of claims 23 and 44-47 under 35 U.S.C. §103(a) as unpatentable over the '863 patent in view of U.S. Patent No. 6,633,587 to Bennett ("the '587 patent").

VII. ARGUMENTS

Initially, Appellant submits that claims 1-24 and 26-49 stand or fall together.

TRAVERSAL, §102(B) REJECTION

Below are arguments traversing the §102(b) rejection[1] of claims 1-21, 24, 26-43 and 48-49 under 35 §102(b) as anticipated by the '863 patent (again, U.S. Patent No. 5,574,863 to Nelson et al.).

For simplicity, this discussion assumes the context of independent claim 1, taken as an example claim.

On page 16 of the Final Office Action, the Examiner present's rebuttal arguments concerning Appellant's previous traversal of the §102(b) rejection. Specifically, the Examiner states:

> Applicant argues in substance that Nelson ['863 patent] does not disclose [a] heartbeat signal and the "are-u-active message" taught by Nelson ['863 patent] may not be interpreted as [a] heartbeat signal.

The Examiner has misunderstood Appellant's argument. This may be due to the Examiner dismissing some parts of Appellant's claim language.

Claim 1 recites more than merely sending a first heartbeat signal and a second heartbeat signal. In addition, claim 1 further recites monitoring reception of the first heartbeat signal and the second heartbeat signal for interruption. As Appellant has explained previously[2], the latter feature of monitoring for interruption the reception of the first and second heartbeat signals represents a distinction over the '863 patent.

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1 The §102(b) rejection begins on page 2 of the Final Office Action.
2 See reply by Appellant filed November 14, 2005, page 2.

In his rebuttal, the Examiner directs Appellant's attention to col. 6, lines 20-30 of the '863 patent; that passage is reprinted here for the reader's convenience:

> Message number 1, ARE-YOU-ACTIVE, is a message sent by the Slave controller to the Master as a heartbeat message (sent periodically) and used by the slave to detect when the master has failed. If the Master is still active and communicating, its only response is YES-ACTIVE, which indicates all is in order. On the other hand, if the Master recognizes that it is no longer serving as Master or is no longer able to serve as Master, its only response is NO-INACTIVE. Given either of these specific, unambiguous replies in response to the specific, unambiguous request, each controller knows exactly what action to take.

The above-quoted passage of the '863 patent teaches that the Slave uses Message No. 1 "to detect when the Master has failed." **Question:** How does the Slave detect failure? **Answer:** In one of two ways. First, if the Slave receives a "NO_ACTIVE" message that was sent in reply to Message No. 1, then the Slave knows that the Master has failed. This is apparent from the above-quoted passage.

The second way that the Slave detects failure is described in the paragraph immediately following the above-quoted passage, namely in col. 6, lines 31-40 of the '863 patent; that passage is reprinted here for the reader's convenience:

> Message number 2, TIMEOUT-I'M-BECOMING-MASTER, is a message sent by the Slave when it detects that a timeout has occurred, i.e., the Master has not replied within a given time period (which is directly related to the rate of the timer based polling of messages). The only response the Master can reply with is OK-BECOMING-SLAVE, meaning the Slave will then become the Master. Alternatively, the Master may not be able to respond due to some failure, and the Slave becomes Master anyway in recognition of the failure to respond.

For certain message types that the Master and Slave respectively are able to send, each expects to receive a reply within a timeout interval. If no reply is received before the timeout interval elapses,, then the Master/Slave treats this as being the same as having received a negative reply, and initiates action appropriate to the circumstances; see col. 5, lines 3-22. Based upon the above-quoted lines 31-40 of the '863 patent, Message No. 1 is one of the messages for which the Slave expects to receive a reply within a fixed amount of time. If that reply is not received before a timeout interval elapses, then the Slave infers from the circumstances that the Master has failed.

The Examiner has interpreted Message No. 1 (again, sent by the Slave) as the first heartbeat signal and the reply to it (that is sent by the Master) as the second heartbeat signal.

Based upon the above-quoted second passage (lines 31-40) in particular and upon the '863 patent taken as a whole, it should be clear that the signal whose reception is monitored for interruption is not Message No. 1, rather it is the Master's reply message for which the Slave monitors reception for interruption. Appellant will assume for the sake of argument that the Slave's monitoring reception of the Master's reply to Message No. 1 corresponds to the claimed monitoring reception of the second heartbeat signal for interruption.

Appellant's claim 1, however, also recites monitoring for interruption the reception the first heartbeat signal. It will be further assumed for the sake of argument that the sending of message No. 1 by the Slave represents the first heartbeat signal. If so, then Appellant asks the **question:** Where does the '863 patent suggest (much less teach) that the Master monitors for interruption the reception of Message No. 1 from the Slave? **Answer:** Nowhere.

Independent claims 24, claim 32, 39 and 48-49 recite features similar to claim 1, respectively, and thus similarly distinguish over the '863 patent. Claims 2-21, 26-31, 33-38 and 40-43 depend from base claims 1, 24, 32 and 39 and exhibit at least the same distinction as their base claims, respectively.

In view of the foregoing discussion, the rejection of the claims as anticipated is improper because the '863 patent does not teach all elements of each rejected claim.

TRAVERSAL,
§103(A) REJECTION,
CLAIM 22

Below are arguments traversing the §103(a) rejection[3] of claim 22 under 35 U.S.C. §103(a) as being unpatentable over the '863 patent taken alone.

Claim 22 depends from claim 1 and exhibits at least the above-noted distinction of claim 1 over the '863 patent.

In view of the foregoing discussion, the rejection of the claim as unpatentable is improper because the rationale for modifying the '863 patent does not address why the distinction of claim 22 would have been obvious.

[3] This §103(a) rejection begins on page 15 of the Final Office Action.

TRAVERSAL,
§103(A) REJECTION,
OF CLAIMS 23 AND 44-47

Below are arguments traversing the §103(a) rejection[4] of claims 23 and 44-47 under 35 U.S.C. §103(a) as being unpatentable over the '863 patent in view of U.S. Patent No. 6,633,587 to Bennett (the '587 patent).

The '587 patent has not been cited as a teaching of the distinction over the '863 patent asserted above. Nor would it be reasonable to assert that it suggests, much less discloses, the above-noted distinctions.

Claims 23 and 44-47 depend from claims 1, 24, 32 and 39 and exhibit at least the above-noted distinctions of claims 1, 24, 32 and 39, respectively.

In view of the foregoing discussion, the rejection of the claims as unpatentable is improper because the rationale for modifying the '863 patent according to the '587 patent does not establish that the respective distinctions would have been obvious.

VIII. CONCLUSION

As (1) it has been explained above why an element of each claim in not disclosed by the assertedly-anticipatory '863 patent such that the §102 rejection based upon that reference is improper, and (2), as it has been explained above that the various obviousness rationales do not establish that the respective distinctions would have been obvious over the art applied such that

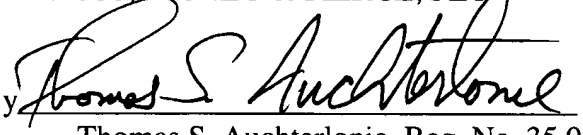
[4] This §103(a) rejection begins on page 15 of the Final Office Action.

the §103 rejections are improper, accordingly, Appellant again requests the Board to reverse the Examiner's rejection and remand the application to the Examiner for either the preparation of a Notice of Allowability or a non-final Office Action.

The Commissioner is authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-2025 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

HARNESS, DICKEY & PIERCE, PLC

By 

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CLAIMS APPENDIX

Claims 1-24 and 26-49 on Appeal:

1. A method of mirroring data in a computer network, comprising the steps of:

establishing at least one connection between a local storage server and a mirror storage server;

receiving a primary storage request from a network host at the local storage server;

sending a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request;

processing the mirror storage request at the mirror storage server;

sending a first heartbeat signal at regular first intervals from the local storage server to the mirror storage server;

sending a second heartbeat signal at regular second intervals from the mirror storage server to the local storage server; and

monitoring reception of the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

2. The method of claim 1, further comprising the steps of:

detecting an interruption in the second heartbeat signal at the local storage server;

closing the established at least one connection; and

queuing mirror storage requests that result from primary storage requests that are received during the detected interruption.

3. The method of claim 2, further comprising the steps of:

receiving the second heartbeat signal at the local storage server after the detected interruption of the second heartbeat signal; and

re-establishing the closed at least one connection between the local storage server and the mirror storage server.

4. The method of claim 3, wherein said mirror storage request sending step comprises the step of:

sending the queued mirror storage requests across the re-established at least one connection after said re-establishing step.

5. The method of claim 4, wherein said detecting step comprises the step of:

detecting an interruption in the second heartbeat signal at the local storage server that has a duration longer than a first predetermined amount of time.

6. The method of claim 3, wherein said re-establishing step comprises the steps of:

monitoring the second heartbeat signal for a probationary interval of time; and

re-establishing the closed at least one connection between the local storage server and the mirror storage server only if no interruptions in the second heartbeat signal are detected during said monitoring step.

7. The method of claim 1, wherein said processing step comprises the step of:

storing data of the received mirror storage request in a mirror storage device corresponding to a primary storage device.

8. The method of claim 7, further comprising the step of:

sending a response across the established at least one connection from the mirror storage server to the local storage server, wherein the response indicates whether said storing data step was successful.

9. The method of claim 5, wherein said establishing step comprises the steps of:

establishing *n* connections between the local storage server and the mirror storage server, wherein each of the *n* connections is between one of *n* worker threads in the local storage server and one of *n* connection threads in the mirror storage server, wherein $n \geq 1$;

storing a local connection array of *n* elements on the local storage server, wherein each element of the local connection array corresponds to one of the *n* local worker thread that operates on the local storage server; and

storing a mirror connection array of *n* elements on the mirror storage server, wherein each element of the mirror connection array corresponds to one of the *n* connection threads on the mirror storage server.

10. The method of claim 9, wherein said local connection array storing step comprises the step of:

storing a local connection array of *n* elements, wherein each element comprises a socket and a timestamp; and

wherein said mirror connection array storing step comprises the step of:

storing a mirror connection array of *n* elements, wherein each element comprises a socket parameter and a timestamp parameter.

11. The method of claim 10, wherein said establishing step further comprises the step of:

establishing each of the *n* connections according to the socket parameter stored in the corresponding one of the *n* elements of the stored local connection array.

12. The method of claim 11, further comprising the steps of:

establishing a mirror heartbeat sender thread and a mirror heartbeat receiver thread in the mirror storage server; and

establishing a local heartbeat sender thread and a local heartbeat receiver thread in the local storage server.

13. The method of claim 12, wherein the first heartbeat signal sending step and said second heartbeat signal sending step each further comprise the step of:

sending a message at time intervals of a second predetermined amount of time.

14. The method of claim 13, wherein said first heartbeat signal sending step further comprises the step of:

updating the timestamp parameter of each of the *n* elements of the mirror connection array whenever the message on the first heartbeat signal is received by the mirror heartbeat receiver thread; and

wherein said second heartbeat signal sending step further comprises the step of:

updating the timestamp parameter of each of the *n* elements of the local connection array whenever the message on the second heartbeat signal is received by the local heartbeat receiver thread.

15. The method of claim 14, wherein said detecting step further comprises the step of:

indicating in one of the *n* elements of the mirror connection array that the corresponding one of the established *n* connections is closed if the timestamp parameter of the one of the *n* elements is older than the first predetermined amount of time.

16. The method of claim 15, wherein said closing step comprises the steps of:

timing out one of the *n* connection threads on the mirror storage server if a request on the corresponding one of the established *n* connections has not arrived in a third predetermined amount of time; and

closing and exiting the timed out connection thread if the corresponding one of the *n* elements in the mirror connection array is indicated to be closed.

17. The method of claim 16, further comprising the steps of:

receiving a first message on the first heartbeat signal after an interruption of the first heartbeat signal; and

re-establishing the *n* connections between the local storage server and the corresponding connection threads on the mirror storage server.

18. The method of claim 17, wherein said second heartbeat signal receiving step comprises the step of:

receiving a first message on the second heartbeat signal after an interruption of the second heartbeat signal.

19. The method of claim 1, wherein the local storage server is operating in an asynchronous mirror mode, further comprising the steps of:

processing the primary storage request; and

sending the results of the processed primary storage request to the network host.

20. The method of claim 1, wherein the local storage server is operating in a synchronous mirror mode, further comprising the steps of:

processing the primary storage request;

waiting for a response corresponding to the sent mirror storage request from the mirror storage server; and

sending the results of the processed primary storage request to the network host after the response is received from the mirror storage server.

21. The method of claim 1, further comprising the step of:

determining whether a LUN related to the received primary storage request is designated to be mirrored.

22. The method of claim 1, wherein the established at least one connection is a TCP connection.

23. The method of claim 13, wherein said sending a message steps each comprise the step of:

sending a user datagram protocol message at time intervals of the second predetermined amount of time.

24. A method of bi-directional mirroring of data in computer networks, comprising the steps of:

establishing a first connection between a local storage server and a remote storage server;

establishing a second connection between the local storage server and the remote storage server;

receiving a first local storage request from a first network host at the local storage server;

sending a first local mirror storage request from the local storage server across the first connection, wherein the first local mirror storage request corresponds to the first received local storage request;

receiving the first local mirror storage request at the remote storage server;

storing data received in the first local mirror storage request in at least one remote storage device coupled to the remote storage server;

receiving a first remote storage request from a second network host at the remote storage server;

sending a first remote mirror storage request from the remote storage server across the second connection, wherein the first remote mirror storage request corresponds to the received first remote storage request;

receiving the first remote mirror storage request at the local storage server;

storing data received in the first remote mirror storage request in at least one local storage device coupled to the local storage server;

sending a first heartbeat signal from the local storage server to the mirror storage server;

sending a second heartbeat signal from the remote storage server to the local storage server; and

monitoring reception of the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

25. (Canceled)

26. The method of claim 24, further comprising the steps of:

detecting an interruption in the second heartbeat signal at the local storage server;

closing the established first connection;

receiving at least a second local storage request at the local storage server; and

queuing at least a second local mirror storage request at the local storage server, wherein the at least a second local mirror storage request corresponds to the received at least a second local storage request.

27. The method of claim 26 further comprising the steps of:

receiving the second heartbeat signal at the local storage server after the detected interruption of the second heartbeat signal; and

re-establishing the closed first connection between the local storage server and the mirror storage server.

28. The method of claim 27, further comprising the step of:

sending the queued at least a second local mirror storage request across the re-established first connection after said re-establishing step.

29. The method of claim 24, further comprising the steps of:

detecting an interruption in the first heartbeat signal at the remote storage server;

closing the established second connection;

receiving at least a second remote storage request at the remote storage server; and

queuing the at least a second remote mirror storage request at the remote storage server, wherein the at least a second remote mirror storage request corresponds to the received at least a second remote storage request.

30. The method of claim 29, further comprising the steps of:

receiving the first heartbeat signal at the remote storage server after the detected interruption of the first heartbeat signal; and

re-establishing the closed second connection between the local storage server and the mirror storage server.

31. The method of claim 30, further comprising the step of:

sending the queued at least a second remote mirror storage request across the re-established second connection after said re-establishing step.

32. A system for mirroring data in a computer network, comprising:

a local storage server that receives a storage request and outputs a mirror storage request, wherein said local storage server outputs a first heartbeat signal at regular first intervals; and

a mirror storage server that receives said mirror storage request, wherein said mirror storage server processes said mirror storage request, wherein said mirror storage server outputs a response corresponding to said mirror storage request to said local storage server, wherein said mirror storage server outputs a second heartbeat signal at regular second intervals and monitors reception of said first heartbeat signal for interruption in the regular receipt thereof;

wherein said local storage server monitors reception of said second heartbeat signal for interruption in the regular receipt thereof.

33. The system of claim 32, wherein said local storage server comprises:

a local work thread generator module that generates *n* local worker threads; and

a local connection array that includes *n* elements; and

wherein said a mirror storage server comprises:

a mirror connection array that comprises *n* elements; and

a mirror connection thread generator module that generates *n* mirror connection threads.

34. The system of claim 33, wherein each of said *n* mirror connection threads are connected to a corresponding one of said *n* local worker threads using a corresponding socket parameter stored in each of said *n* elements of said mirror connection array to form *n* corresponding connections.

35. The system of claim 34, wherein said local storage server comprises:

a local heartbeat thread generator module that generates a local heartbeat sender thread and a local heartbeat receiver thread; and

wherein said mirror storage server comprises:

a mirror heartbeat thread generator module that generates a mirror heartbeat sender thread and a mirror heartbeat receiver thread;

wherein said local heartbeat sender thread sends said first heartbeat signal to said mirror heartbeat receiver thread, and said mirror heartbeat sender thread sends said second heartbeat signal to said local heartbeat receiver thread.

36. The system of claim 35, wherein each of *n* elements of said local connection array comprises a timestamp parameter, wherein said local heartbeat receiver thread updates each said timestamp parameter in said local connection array when a message is received on said second heartbeat signal.

37. The system of claim 36, wherein said local heartbeat sender thread indicates in at least one of the *n* elements of the mirror connection array that the corresponding at least one of the established *n* connections is closed if the corresponding timestamp parameter is older than the first predetermined amount of time.

38. The system of claim 36, wherein one of said *n* mirror connection threads times out if a corresponding mirror storage request is not received from said local storage server for a second predetermined amount of time, wherein after said time out said one of said *n* mirror connection threads checks the timestamp of the corresponding one of the *n* elements and exits if said corresponding timestamp is older than a second predetermined amount of time.

39. A computer program product comprising a computer useable medium having computer program logic recorded thereon for enabling at least one processor to mirror data in a computer network, said computer program logic comprising:

means for enabling the processor to establish at least one connection between a local storage server and a mirror storage server;

means for enabling the processor to receive a primary storage request from a network host at the local storage server;

means for enabling the processor to send a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request;

means for enabling the processor to send a first heartbeat signal at regular first intervals from the local storage server to the mirror storage server; and

means for enabling the processor to send a second heartbeat signal at regular second intervals from the mirror storage server to the local storage server; and

means for monitoring reception of ~~at least one~~ the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

40. The computer program product of claim 39, further comprising:

means for enabling the processor to detect an interruption in the second heartbeat signal at the local storage server; and

means for enabling the processor to queue mirror storage requests that result from primary storage requests that are received during the detected interruption.

41. The computer program product of claim 40, further comprising:

means for enabling the processor to receive the second heartbeat signal at the local storage server after the detected interruption of the second heartbeat signal; and

means for enabling the processor to re-establish the closed at least one connection between the local storage server and the mirror storage server.

42. The computer program product of claim 41, further comprising:

means for enabling the processor to send the queued mirror storage requests across the re-established at least one connection.

43. The method of claim 39, further comprising the step of:

means for enabling the processor to receive a response across the established at least one connection from the mirror storage server, wherein the response indicates whether data in said sent mirror storage request was successfully stored in a mirror storage device.

44. The method of claim 1, wherein at least one of the step of sending a first heartbeat signal and the step of sending a second heartbeat signal includes:

periodically sending a User Datagram Protocol (UDP) message.

45. The method of claim 24, wherein at least one of the step of sending a first heartbeat signal and the step of sending a second heartbeat signal includes:

periodically sending a User Datagram Protocol (UDP) message.

46. The system of claim 32, wherein at least one of the local storage server and the mirror storage server is operable to send the first and second heartbeat signals, respectively, by

periodically sending a User Datagram Protocol (UDP) message.

47. The computer program product of claim 39, wherein at least one of the means for enabling the processor to send a first heartbeat signal and the means for enabling the processor to send a second heartbeat signal includes:

means for periodically sending a User Datagram Protocol (UDP) message.

48. A method of mirroring data in a computer network, comprising the steps of:

establishing at least one connection between a local storage server and a mirror storage server;

receiving a primary storage request from a network host at the local storage server;

sending a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request;

processing the mirror storage request at the mirror storage server;

sending a first heartbeat signal at regular first intervals from the local storage server to the mirror storage server;

sending a second heartbeat signal, independent of the first heartbeat signal, at regular second intervals from the mirror storage server to the local storage server; and

monitoring reception of at least one the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

49. A method of mirroring data in a computer network, comprising the steps of:

establishing at least one connection between a local storage server and a mirror storage server;

receiving a primary storage request from a network host at the local storage server;

sending a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request;

processing the mirror storage request at the mirror storage server;

sending a first heartbeat signal using a connectionless protocol at regular first intervals from the local storage server to the mirror storage server;

sending a second heartbeat signal using a connectionless protocol at regular second intervals from the mirror storage server to the local storage server; and

monitoring reception of at least one the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively.

EVIDENCE APPENDIX

NONE

RELATED PROCEEDINGS APPENDIX

NONE